

REMARKS/ARGUMENTS

In an Office Action dated July 24, 2006, the Examiner has requested that the Abstract be amended. The Applicant has supplied a substitute Abstract and respectfully requests that this new Abstract be considered.

The Examiner indicated that the information disclosure statement filed 12/16/2004 has been placed in the application file, but the information referred to therein has not been considered for failing to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each cited foreign patent document. On October 5, 2006, we spoke to the Examiner who stated he did not receive any copies of the foreign documents disclosed in the information disclosure statement filed 12/16/2004. Accordingly, included herewith are copies of such foreign documents. Since they were in a foreign search report, the Examiner is respectfully requested to consider the same in relation to this application.

The Examiner has also objected to the drawings as failing to show a feature disclosed in claim 10. The drawing objection is noted. Applicant appreciates the Examiner's suggestion that the screw mentioned in claim 10 be either shown or canceled from the claim. The reference to the screw has been deleted from claim 10 and Applicant respectfully requests the Examiner reconsider and withdraw the objection to the drawings in their present form.

In addition, the Examiner rejected claim 4 under 35 U.S.C. § 112 due to insufficient antecedent basis. The Applicant has amended claim 4 to depend on claim 3 to provide for proper antecedent basis.

The Examiner rejected claims 1, 2, 6, 7 and 10 under 35 U.S.C. § 103(a) as being unpatentable over Tabor (U.S. 3,710,674) in view of Overaker (U.S. 6,942,666).

The Applicant respectfully submits that claims 1, 2, 6, 7 and 10 as presented are not obvious under 35 U.S.C. § 103(a) over Tabor (U.S. 3,710,674) in view of Overaker (U.S. 6,942,666) as alleged by the Examiner for the following reasons:

The present claims recite a bevel located in the head part of the dowel jacket. The bevel of claim 1 extends from the head flange toward the outer circumference of the dowel jacket so that the width of the bevel, as can be seen in FIG. 2, decreases from the head flange to the opening of the slit. The bevel permits direct contact of a screw thread section with the bone so as to avoid rotation of the dowel jacket when the screw is being turned. In contrast, Tabor does not

disclose the element of a bevel. The Examiner states that Tabor shows a longitudinal slit having a bevel. In fact, Tabor does not mention the use of a bevel at all. Tabor merely discloses a longitudinal split 8 between the ends of the sleeve that is wider at the larger end of the sleeve than it is at the smaller end. The widening of the split at the wider end of the sleeve as set forth in Tabor is not comparable to the bevel element described in the present claims.

In addition, U.S. Patent No. 6,942,666 to Overaker shows a bone anchoring device for securing suture or cable within a bone hole. To fix the cable in the bone hole, the anchor includes means for clamping the cable and spreading the anchoring device in the bone hole by pushing a member into the bone hole. In contrast, the present claims are directed to a bone dowel for inserting a screw to fix elements together, such as an osteosynthesis plate to the outside of a bone. Further, Overaker uses a plurality of elements for securing the cable or suture, whereas the present claims consist of a single element.

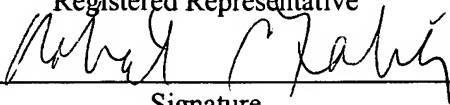
Accordingly, the Applicant submits that the rejected claims are allowable over the prior art cited by the Examiner.

Although the Examiner has stated that claims 3-5 and 8-9 would be allowable if rewritten in independent form, the Applicant submits that claim 1 is allowable in view of the above arguments. However, the Applicant has added new independent claims 11-15 which are claims 3-5 and 8-9 combined with claim 1 respectively. Accordingly, allowance of claims 11-15 is requested.

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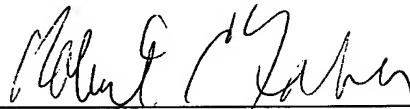
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October 23, 2006

Date of Signature

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⑤④ **Spreizdübel für eine zementfreie Verankerung von Knochenimplantaten.**

⑤⑦ Der Hohlkörper (1) eines Spreizdübels zur Verankerung von Implantaten in Knochen ist entlang seines äusseren Umfanges polygonförmig ausgebildet.

Damit wird eine Sicherung gegen unbeabsichtigte Rotationen, besonders bei Verwendung von Schrauben als Spreizkörper, erreicht.

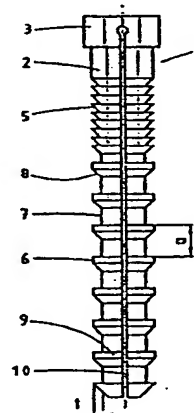


FIG. 1

EP 0 340 159 A1

Beschreibung

Spreizdübel für eine zementfreie Verankerung von Knochenimplantaten

Die Erfindung betrifft einen Spreizdübel für eine zementfreie Verankerung von Knochenimplantaten, bestehend aus einem einseitig offenen, mit Hilfe von Längsschlitz aufspreizbaren Hohlkörper und einem in den Hohlkörper eintreibbaren Spreizkörper, wobei der Hohlkörper auf seiner Aussenmantelfläche widerhakenartige, zirkuläre Verzahnungen trägt.

Derartige Spreizdübel sind beispielsweise bekannt aus der CH-PS 662 501. Bei dieser Konstruktion besteht der Spreizkörper aus einem in Richtung der Längsachse einschlagbaren Zapfen, bei dessen Eintreiben keine Drehmomente auf den Dübel ausgeübt werden. Sehr häufig sollen mit Implantat-Spreizdübel jedoch, wie in anderen Gebieten der Technik, Schrauben verankert werden. Bei den bisherigen Konstruktionen der Dübel ist beim Einschrauben der Schraube häufig die Schwierigkeit aufgetreten, dass der von der Schraube noch nicht oder nur wenig aufgespreizte Dübel sich in der Knochenbohrung "mitdreht", und sich somit keine feste Verankerung des Dübels ergibt. Als Folge davon wird selbstverständlich das Implantat ungenügend fixiert, das beispielsweise aus Kontraktions- oder Distraktionsplatten besteht, die zur Behandlung von Wirbelsäulen-Deformationen zwischen zwei Wirbel ausgespannt und in diesen durch Spreizdübel mit Schrauben gehalten werden.

Aufgabe der Erfindung ist es daher, einen Spreizdübel zu schaffen, der unbeabsichtigten Rotationen, beispielsweise beim Einschrauben einer Schraube, widersteht. Diese Aufgabe wird dadurch gelöst, dass der äussere Umfang des Hohlkörpers mindestens über eine Teillänge des Dübels im Querschnitt polygonförmig ausgebildet ist.

Bei der Implantation wird die Bohrung für die Aufnahme des neuen Dübels auf einen Durchmesser ausgebohrt, der dem Abstand zweier einander gegenüberliegender Seiten entspricht, so dass die Kanten des Polygonzuges bereits in die Knochen substanz eindringen. Die Polygonform der Verzahnungen des in die Bohrung eingesetzten Hohlkörpers des Dübels wirkt dann als Drehsicherung gegen unbeabsichtigte Rotationen des Dübels.

Bei sehr vielen Knochen variieren Knochendichte und Knochenhärte sehr stark, wie beispielsweise beim Wirbel, bei dem der Wirbelbogen aus harter, dichter, kortikaler Knochen substanz und der Wirbelkörper in seinem Inneren aus relativ weichem und "luftigem" spongiösen Material bestehen. In an sich bekannter Weise kann bei dem neuen Dübel diesen Materialunterschieden dadurch Rechnung getragen werden, dass der Hohlkörper nahe dem geschlossenen Ende der Längsschlitz eine Feinverzahnung trägt, an die zum offenen Ende hin eine Grobverzahnung anschliesst.

Beim Eindringen der Grobverzahnung in das relativ weiche spongiöse Material besteht die Gefahr, dass die Zahnschneiden unter Biegebelastungen allmählich immer weiter in den Knochen eindringen; das hat zur Folge, dass die in den Dübel eingeschraubte Schraube immer weiter in den Dübel

"versinkt" und schliesslich locker wird. In diesem Fall bewirkt die Polygonform zusätzlich, dass die Biegebelastungen über eine relativ breite Fläche auf den Knochen übertragen werden; darüberhinaus lässt sich diese Wirkung der Polygonform in dem relativ weichen spongiösen Knochengewebe verstärken, wenn die Zähne der Grobverzahnung zu achsparallelen Flächen abgestumpft sind.

Weiterhin kann die Verankerung des Dübels im spongiösen Material verbessert werden, wenn der axiale Abstand der Zähne der Grobverzahnung grösser ist als ihre Zahntiefe.

Um die Anpressung des Dübels in unterschiedlichen Knochensubstanzen zu vergleichmässigen, ist es weiterhin zweckmässig, wenn die Innenbohrung des Hohlkörpers im Bereich der Feinverzahnung zylindrisch und im Bereich der Grobverzahnung konisch zulaufend ausgebildet ist.

Im folgenden wird die Erfindung anhand von Ausführungsbeispielen im Zusammenhang mit der Zeichnung näher erläutert.

Fig. 1 ist eine Seitenansicht einer Ausführungsform des neuen Dübels;

Fig. 2 ist eine Aufsicht auf Fig. 1 von oben;

Fig. 3 gibt einen Längsschnitt durch eine zweite Ausführungsform des neuen Dübels wieder;

Fig. 4 ist eine zu dem Dübel nach Fig. 3 passende Aufspreizschraube;

Fig. 5 schliesslich stellt schematisch den neuen Dübel, eingesetzt in einen Wirbel dar.

Der beispielsweise aus körperverträglichem Kunststoff, üblicherweise aus Polyäthylen oder aus einem Metall, bestehende Hohlkörper 1 des Spreizdübels nach Fig. 1 hat einen im Durchmesser gegenüber dem Kern 2 vergrösserten Kopf 3, der neben der in diesem Fall sechskantigen Aussenform einen Innensechskant 4 zur Aufnahme eines entsprechenden, nicht gezeigten Setz- oder Einschlaginstrumentes aufweist. Nach unten setzt sich der ebenfalls sechskantige Kern 2 in einer Feinverzahnung 5 fort. An die Feinverzahnung 5 schliesst eine Grobverzahnung 6 an, die sich bis zum freien Ende des Dübels erstreckt. Sowohl die Feinverzahnung 5 als auch die Grobverzahnung 6 sind in Umfangsrichtung ebenfalls polygonförmig, im vorliegenden Fall wiederum als Sechskant, ausgebildet. In dem in Fig. 1 gezeigten Beispiel ist nur der obere Bereich des Kernes 2, der im Durchmesser dem Durchmesser der Verzahnungen 5 und 6 entspricht, polygonförmig gestaltet, während der Stamm 7, aus dem die Grobverzahnung 6 "herauswächst", eine zylindrische Form hat. Selbstverständlich ist es jedoch auch möglich, den Stamm 7 und die Flanken 8 der Grobverzahnung 6 als Polygone auszubilden. Der Abstand a der Zähne der Grobverzahnung 6 ist grösser als die Zahntiefe t, damit zwischen den einzelnen Zahnreihen möglichst viel Knochensubstanz der relativ weichen Spongiosa 12 (Fig. 5) für die Verankerung zur Verfügung steht.

Die Zähne der Grobverzahnung 6 sind an ihren

Spitzen zu ebenen achsparallelen Flächen 9 abgestumpft; diese Flächen bewirken eine Verteilung der von Biegebelastung herrührenden Drücke oder Kräfte auf einen relativ grossen Bereich des weichen Knochengewebes 12, in das die Grobverzahnung 6 zu liegen kommt.

Die Spreizung des Hohlkörpers 1 wird durch Längsschlitz 10 erreicht, die sich vom freien Ende bis in den Kopf 3 erstrecken und von denen im allgemeinen mindestens zwei auf dem Umfang verteilt sind.

Obwohl das Aufspreizen des Hohlkörpers 1 auch durch Einschlagen eines Zapfens erfolgen kann, werden dafür Spannschrauben bevorzugt, die nahe ihrem Kopf 15 (Fig. 4) über eine gewisse Länge ein Gewinde 16 tragen, an das sich ein gewindefreier Stamm 14 anschliesst. Das Gewinde 16 wird zum Aufspreizen des Hohlkörpers 11, der als Unterschied zum Hohlkörper 1 von Fig. 1, lediglich keinen Kopf mit vergrössertem Durchmesser aufweist, in ein Gewinde 17 der Längsbohrung 18 des Hohlkörpers 11 eingeschraubt. Im Bereich des Gewindes 17 und im anschliessenden Teil, der aussen die widerhakenartige Feinverzahnung 5 trägt, ist die Längsbohrung 18 zylindrisch, während sie sich im Bereich der Grobverzahnung 6 zum freien Ende hin konisch verjüngt.

Die in Fig. 5 dargestellte Anwendung des neuen Spreizdübels zeigt, dass sich die Feinverzahnung 5 vor allem im harten kortikalen Gewebe 13 des Wirbelbogens erstreckt, während die Grobverzahnung 6 in das weiche spongiöse Gewebe 12 im Innern des Wirbelkörpers 19 verläuft.

Selbstverständlich ist die Polygonform des Querschnitts nicht auf diejenige eines Sechskantes beschränkt; sie kann in gleicher Weise auch eine beliebige andere Kantenzahl haben.

Patentansprüche

1. Spreizdübel für eine zementfreie Verankerung von Knochenimplantaten, bestehend aus einem einseitig offenen, mit Hilfe von Längsschlitz 10 aufspreizbaren Hohlkörper und einem in den Hohlkörper eintreibbaren Spreizkörper, wobei der Hohlkörper auf seiner Aussenmantelfläche widerhakenartige, zirkuläre Verzahnungen trägt, dadurch gekennzeichnet, dass der äussere Umfang des Hohlkörpers (1, 11) mindestens über eine Teillänge des Dübels im Querschnitt polygonförmig ausgebildet ist.

2. Spreizdübel nach Anspruch 1, dadurch gekennzeichnet, dass der Hohlkörper (1, 11) nahe dem geschlossenen Ende der Längsschlitz 10 eine Feinverzahnung (5) trägt, an die zum offenen Ende hin eine Grobverzahnung (6) anschliesst.

3. Spreizdübel nach Anspruch 2, dadurch gekennzeichnet, dass die Zähne der Grobverzahnung (6) zu achsparallelen Flächen (9) abgestumpft sind.

4. Spreizdübel nach Anspruch 2 oder 3, dadurch gekennzeichnet, dass der axiale Abstand (a) der Zähne der Grobverzahnung (6)

grösser ist als ihre Zahntiefe (t).

5. Spreizdübel nach einem der Ansprüche 2 bis 4, dadurch gekennzeichnet, dass die Innenbohrung (18) des Hohlkörpers (11) im Bereich der Feinverzahnung (5) zylindrisch und im Bereich der Grobverzahnung (6) konisch zulaufend ausgebildet ist.

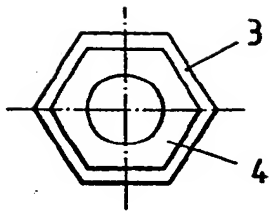


FIG. 2

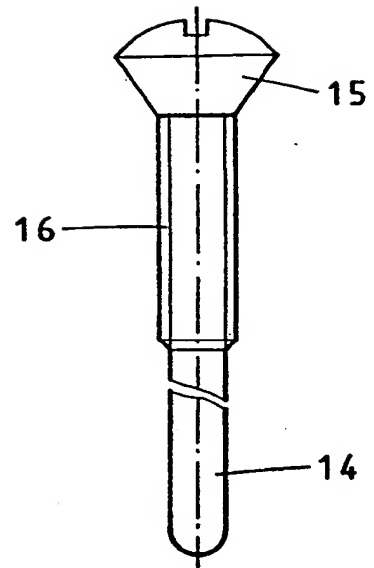


FIG. 4

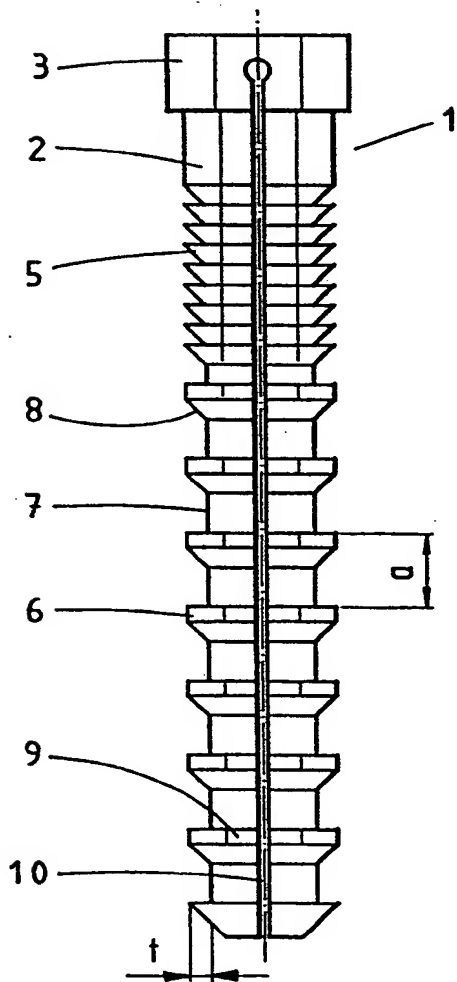


FIG. 1

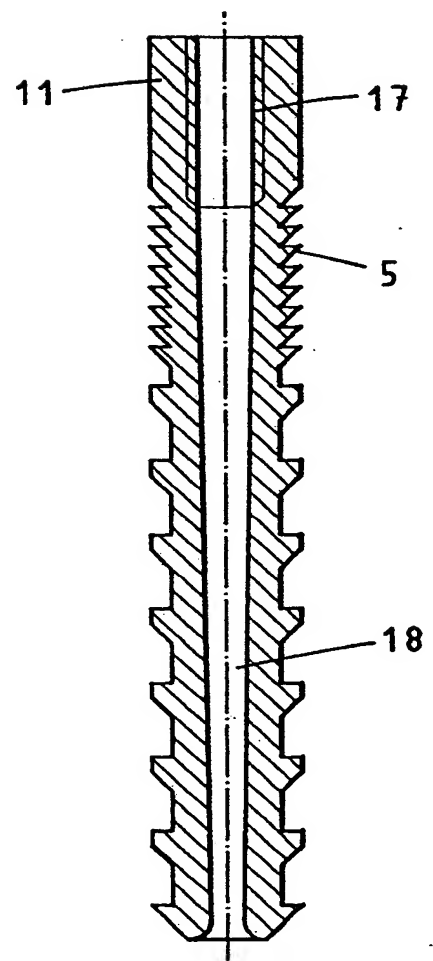


FIG. 3

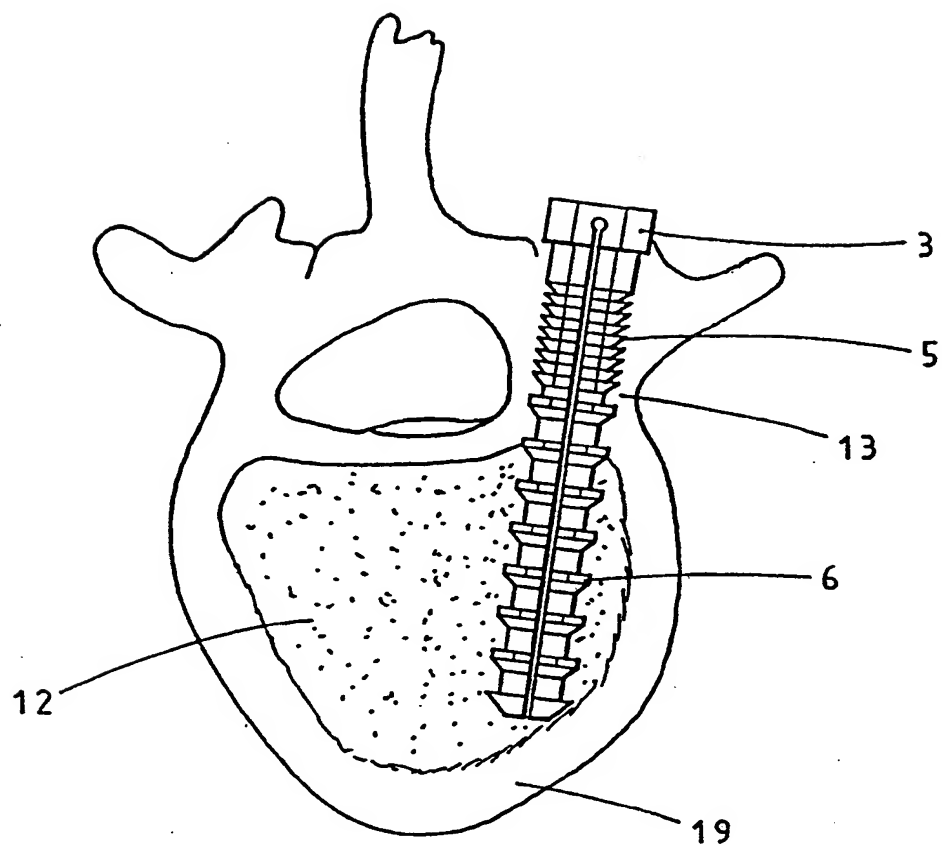


FIG. 5



Europäisches
Patentamt


EUROPÄISCHER RECHERCHENBERICHT

Nummer der Anmeldung

EP 89 81 0231

EINSCHLÄGIGE DOKUMENTE			
Kategorie	Kennzeichnung des Dokuments mit Angabe, soweit erforderlich, der maßgeblichen Teile	Betrifft Anspruch	KLASSIFIKATION DER ANMELDUNG (Int. Cl.4)
X	US-A-4 013 071 (ROSENBERG) * Figuren 5,7,8 *	1.	A 61 B 17/58
X	DE-U-8 520 206 (A. FISCHER) * Figuren 1-3 *	1	
X	US-A-4 611 581 (A.D. STEFFE) * Figuren 8,12-14 *	1	
			RECHERCHIERTE SACHGEBIETE (Int. Cl.4)
			A 61 B A 61 F
Der vorliegende Recherchenbericht wurde für alle Patentansprüche erstellt			
Recherchenort DEN HAAG		Abschlußdatum der Recherche 18-07-1989	Prüfer ARGENTINI A.
KATEGORIE DER GENANNTEN DOKUMENTE			
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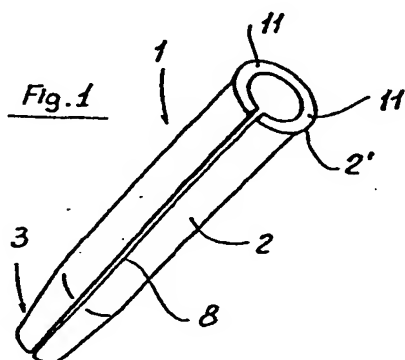
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(54) Wall dowel.

(57) The wall dowel comprises a substantially tubular, cylindrical body (2), provided with a longitudinal slot (8) extending through the overall length of the body (2), and effective to be inserted into a hole (4) formed in the wall, the hollow or bore (5) of the body (2), therein a set screw may be engaged (7), having a first portion (6) of enlarged diameter ending with a frustum shaped tapering portion (6') effective to facilitate the insertion of the set screw (7).



The present invention relates to a wall expansion small block, particularly for hollow tile walls and the like.

As it is known, several types of expansion blocks are presently commercially available, which generally consist of a cylindrical body provided, at one end thereof, with a small collar and including a pair of substantially semicircular wings or legs extending from the mentioned collar and effective to be inserted into a hole as formed in the wall.

By introducing a set screw, the mentioned two legs are caused to diverge from one another, with a substantially radial movement, thereby obtaining a good anchoring of the expansion small block in the wall.

While the hereinabove mentioned type of expansion block has afforded generally satisfactory results with the so-called solid walls, it is however of very poor performance as it is applied to the hollow tile walls since, as the set screw is applied, the mentioned legs are caused to diverge, thereby the set screw is able of engaging the small expansion block exclusively at the collar region.

Thus, the set screw may loose due to vibration, and disengage from the expansion block.

Another drawback of the known small expansion blocks is that the set screw, which is not firmly locked in the small block, because of the continuous movements it is subjected to, inevitably produces an

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enlarged zone at the thread engagement region and accordingly is susceptible to disengaging.

Accordingly, the task of the present invention is to overcome the hereinabove mentioned drawbacks, by providing such a wall expansion small block which is effective to engage the set screw across its overall length, thereby preventing the set screw from disengaging even in highly stressed and vibration conditions.

Within that task, it is a main object of the present invention to provide such a wall expansion small block which, owing to its mentioned characteristics, is particularly effective to be used for hollow tile walls, or in walls wherein gaps are formed, while being provided for a general purpose use.

Another object of the present invention is to provide such a wall expansion small block which, owing to its arrangement and construction, is very reliable in operation.

According to one aspect of the present invention, the above task and objects, as well as yet other objects which will become more apparent hereinafter, are achieved by a wall expansion small block characterized in that it comprises a substantially tubular cylindrical body, provided with a longitudinal slot extending through the overall length of said body, and effective to be inserted into a hole formed in said wall, the hollow or bore of said body, therein a screw may be engaged, having a first portion of enlarged diameter.

Further characteristics and advantages of the wall expansion small block according to the present invention will become more apparent from the following detailed description of a preferred embodiment of said block, being illustrated, by way of an example and not of limitation, in the figures of the accompanying drawing, where:

Fig.1 is a perspective view illustrating the small expansion block according to the present invention;

Fig.2 is a longitudinal cross-sectional view of that same small expansion block;
and

Fig.3 is a schematic view illustrating the small expansion block as applied to a hollow tile wall.

With reference to the above mentioned figures, the wall expansion small block according to the present invention, indicated overallly at 1, comprises a substantially cylindrical body 2, provided with an abutment collar 2' which is preferably made starting from a suitable plastics material.

That body defines, at its front end, in the introduction direction of said body, an outer tapering portion 3, of frustum shape, effective to facilitate the insertion of said body into a hole 4 formed in the wall.

In its inside the body 2 defines a hollow or bore 5, extending for the overall length of said body and provided, at its rear end portion, that is at that

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end which will be flush with the wall, with an enlarged diameter portion 6, ending with a frustum shaped tapered zone 6' effective to act as a lead-in element for the set screw 7.

A main feature of the present invention is that the body 2 is provided with a longitudinal slot 8 which preferably extends through the overall length of said body and is effective to allow for said body to radially expand as the set screw is inserted therein which set screw 7, as it is known, has a diameter greater than the diameter of the hollow or bore 5, which latter is of elliptical shape, that is with a respective enlarged portion on either side thereof.

With the disclosed arrangement, the screw 7 engages the surface of the hollow 5, in the inside of the body 2, through the overall length of the small block, even if the latter is inserted into a hollow tile wall or into a wall wherein gaps are formed.

As it is known, in this type of application, the conventional expansion small blocks, provided with a middle slot, tend to open and engage the set screw exclusively at the solid thickness of the tile or wall and, accordingly, they may disengage because of vibrations.

On the contrary, in the disclosed embodiment the complete engagement between the set screw and expansion small block affords the possibility of firmly

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anchoring the expansion block to the wall, thereby the expansion block stabilizing effect will be obtained not only at the wall thickness, but also through the overall length of the expansion block, with surprising practical results.

More specifically, the provision in the inside of the expansion small block of a first enlarged diameter hollow portion 6 which substantially extends through the overall thickness of the plastering 9 and hollow tile 10, affords the possibility of inserting into said small expansion block set screws having comparatively greater cross-sections than the inner cross-section of that portion of the expansion small block which protrudes from the tile itself.

It should also be noted that the body 2 of the expansion small block is provided with suitably enlarged wall portions 11 and 11' which are such that, as the set screw is introduced into the solid material of a wall, it will be screwed into the expansion block, whereas, as said screw passes through gaps of the wall, it causes the body 2 of the expansion block to expand at said gaps.

Thus, the body 2 tends to radially expand, in such a way as to be firmly anchored in the wall, even in the case of hollow tiles, thereby the engagement between the wall and the small expansion block will be reduced to a very small zone.

However, also in that case, the set screw will

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be fully engaged in the small expansion block, thereby it will afford a sure coupling.

From the above disclosure and the figures of the accompanying drawings, there will be self-evident the great functionality and use facility characterizing the wall expansion small block according to the present invention.

In particular it is to be pointed out that the constructional approach of designing the body 2 with a single cut portion, consisting of the slot 8, is effective to prevent said body from being spread apart and removed from the set screw; on the contrary it will closely encompass said set screw, thereby the latter will engage the expansion small block in a very stable condition.

In practicing the invention, though the best results have been obtained by using plastics materials, the used materials may be any, depending on the contingent requirements.

C L A I M S

- 1- A wall expansion small block characterized in that it comprises a substantially tubular cylindrical body (2), provided with a longitudinal slot (8) extending through the overall length of said body, and effective to be inserted into a hole (4) formed in said wall, the hollow or bore (5) of said body (2), therein a screw may be engaged, having a first portion (6) of enlarged diameter.
- 2- A wall expansion small block, according to the preceding claim, characterized in that said substantially cylindrical body (2) is provided, at the front end portion thereof, in the body introduction direction, with a frustum tapering portion (3), effective to facilitate the insertion of said body (2) into said hole (4), and, at the rear end portion thereof, with an abutment collar (2').
- 3- A wall expansion small block, according to claim 1, characterized in that said hollow (5) is provided, at the rear end portion thereof, with an enlarged diameter portion (6) ending with a frustum shaped tapering portion (6') effective to facilitate the insertion of a set screw (7).
- 4- A wall expansion small block, according to one or more of the preceding claims, characterized in that the hollow or bore (5) of said tubular cylindrical

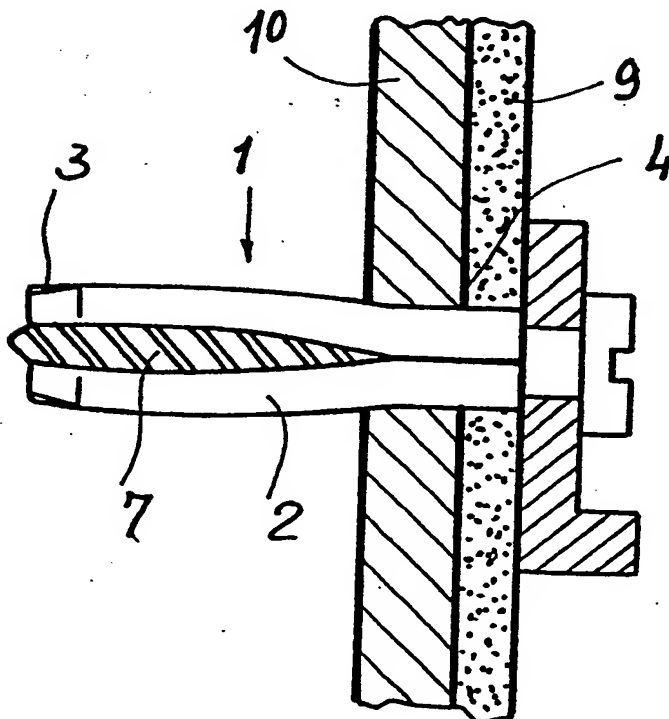
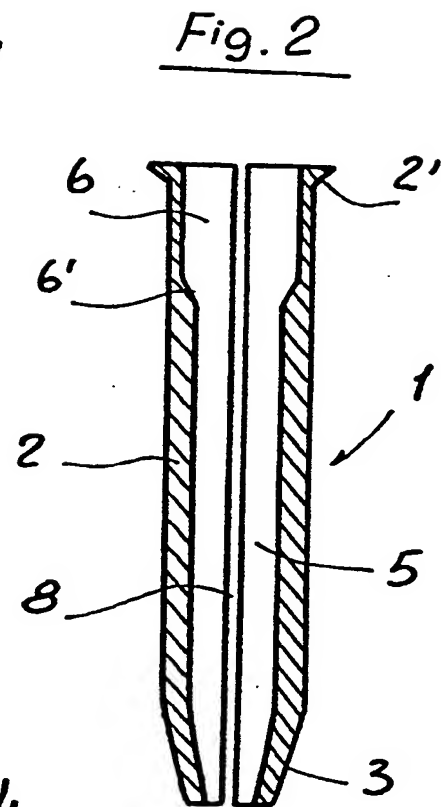
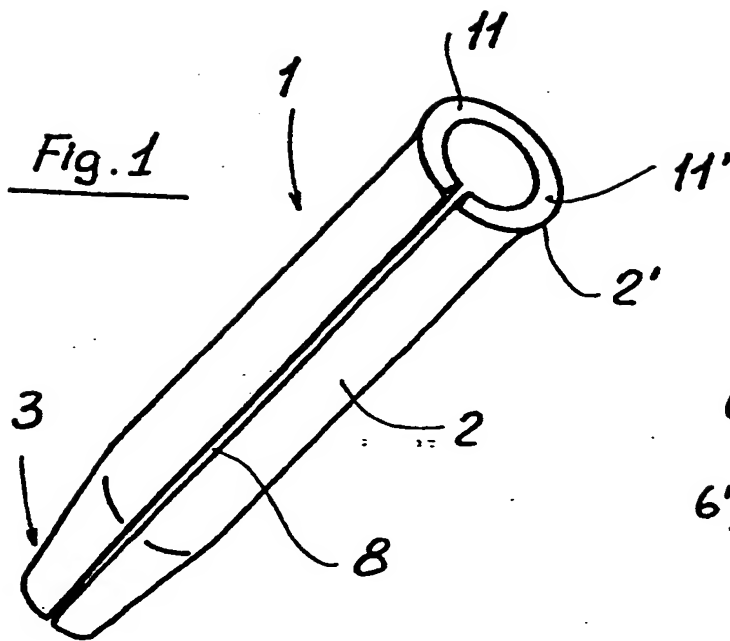
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body is of elliptical shape, that is it is provided with an enlarged portion on either side thereof.

5- A wall expansion small block, according to one or more of the preceding claims, characterized in that said longitudinal enlarged portions are so arranged and designed that, as the set screw is screwed through the wall solid material, it will be screwed into the expansion block body, whereas as said set screw (7) is screwed through gaps in the wall, it is effective to cause said expansion block body to expand.

6- A wall expansion small block, according to one or more of the preceding claims, characterized in that it comprises, in the inside thereof, a first enlarged diameter hollow portion (6) effective to extend through the overall thickness of the plastering and the hollow tile therethrough said hole (4) is formed, said portion (6) being also effective to afford the possibility of inserting into said hole (4) set screws having a comparatively greater cross-section than the inner cross-section of the portion of the expansion block protruding from the tile.

7- A wall expansion small block, according to the preceding claims and substantially as disclosed and illustrated for the intended objects.





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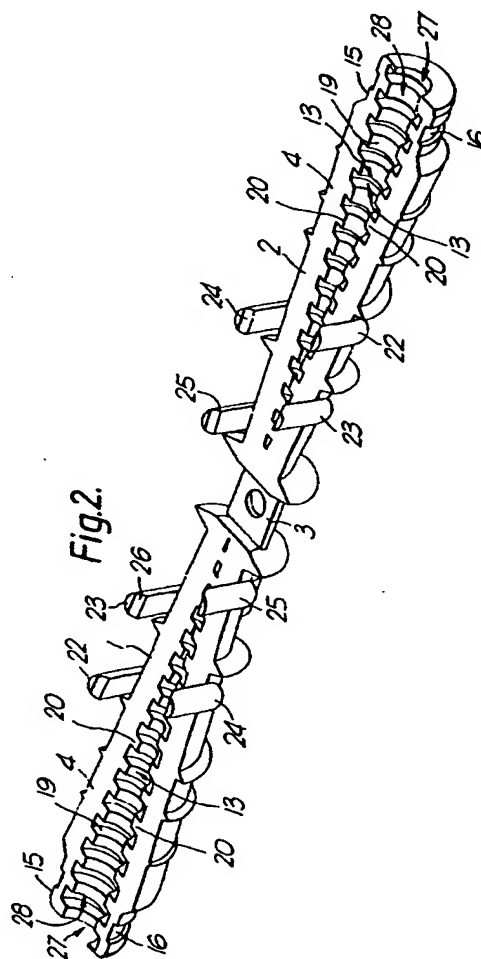
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(54) **Fastener for securing an orthopaedic device to a bone.**

(57) A fastener for securing an orthopaedic device to a bone comprising an expandable plug made from a biodegradable or biostable material and having two segments (1,2) which when placed together provide an open ended tapered inner bore provided with retention means (120), and a retention element which can act on the orthopaedic device to locate it against said bone and which when entered into the bore under pressure locates in the retention means and acts to expand the plug, said segments being interconnected at their ends spaced away from the open end of the bore.



EP 0 528 573 A1

This invention relates to a fastener for securing an orthopaedic device to a bone and more particularly to a biodegradable multi-part fastener device.

According to the present invention a fastener for securing an orthopaedic device to a bone comprises an expandable plug made from a biodegradable or biostable material and having two or more segments which when placed together provide an open ended tapered inner bore provided with retention means, and a retention element which can act on the orthopaedic device to locate it against said bone and which when entered into the bore under pressure locates in the retention means and acts to expand the plug, and interconnection means spaced away from the open end of the inner bore for holding said segments in alignment during insertion.

In a preferred construction said interconnection between the segments is in the form of a hinge.

The segments may have outwardly projecting abutments to engage and locate in an opening in said bone to which the device is to be fastened.

The segments can be made of a biocompatible material which may be from the known family and classes of synthetic biodegradable materials such as polyglycolic, polylactic acid polymers and copolymers, polyhydroxybutyrate, polydioxanone etc., or from soluble type synthetic materials i.e., polyethylene oxide block copolymers, polyvinyl alcohols, cellulose, etc., or from natural resorbable materials, such as fibrin, collagen, gelatin, dextran etc. Alternatively the segments may be constructed from an essentially biostable material such as a polyethylene, polypropylene or another synthetic polymer. Any of these materials may be of generally homogeneous form or reinforced by fillers or fibres of other or similar materials.

The outwardly projecting abutments can have an external tooth form of relatively large pitch and may be formed by radial and helical fins.

Alternative helical fins can be opposite handed so that when engaging bone these do not allow for any rotational unlocking of the fastener.

The retention means in the bore can be provided by a series of engagement ribs and these may be in the form of a tapered screw thread.

Preferably the retention element is a screw or a circumferentially ribbed pin and the screw or pin may be of generally cylindrical shape with an overlaying tapering tooth form or ribbing.

The retention means can be metallic from the range of metals used in orthopaedic implants, that is Cobalt-Chrome, Ti alloys, stainless steels or it can be made from synthetic polymer or polymeric, from the same range of biodegradable materials as are used in the segment construction or from some other synthetic polymer of known biocompatibility.

Means can also be included for preventing expansion of the plug adjacent the open end of the bore,

these means being in the form of a sleeve surrounding the plug.

The segments can be provided with guides to assist assembly together to form the expandable plug.

The invention can be performed in various ways but one embodiment will now be described by way of example and with reference to the accompanying drawings in which :-

Figure 1 is a side elevation of an assembled expandable plug for use in the fastener according to the present invention;

Figure 2 is an isometric view of the expandable plug in an open position and ready for use;

Figure 3 is an isometric view of the plug shown in Figure 2 in a partially closed position together with a sleeve which forms part of the wide end of the plug when assembled;

Figure 4 is a cross-sectional side view of the sleeve shown in Figure 3;

Figure 5 is a side elevation of a retention element in the form of a circumferentially ribbed pin for use with the expandable plug shown in Figures 1 to 4;

Figures 6, 7 and 8 show various stages in the assembly of the device when used to secure an orthopaedic device to a bone.

As shown in Figures 1, 2 and 3 an expandable plug which forms part of the fastener comprises a moulding having a first segment 1 and a second segment 2. The segments can be made of a biocompatible material which may be from the known family and classes of synthetic biodegradable materials such as polyglycolic, polylactic acid polymers and copolymers, polyhydroxybutyrate, polydioxanone etc., or from soluble type synthetic materials i.e., polyethylene oxide block copolymers, polyvinyl alcohols, cellulose, etc., or from natural resorbable materials, such as fibrin, collagen, gelatin, dextran etc. Alternatively the segments may be constructed from an essentially biostable material such as a polyethylene, polypropylene or another synthetic polymer. Any of these materials may be of generally homogeneous form or reinforced by fillers or fibres of other or similar materials.

In the construction shown in the drawings the two segments are made as a single moulding being joined together by a web 3. Each segment is of substantially semicircular cross section so that when the two segments 1 and 2 are folded over around the web 3, which acts as a hinge in the manner shown in Figure 3 they can be placed together with their flat surfaces 4 in engagement to provide what is in effect a tapering cylindrical plug as shown in Figure 1, the web 3 acting as interconnecting means to hold the segments in alignment. In Figure 1 only the basic shape of the plug is shown, the details being apparent from Figures 2 and 3.

Outwardly projecting abutments are provided on

the outer surfaces of the segments 1 and 2 and are in the form of longitudinally extending fins 5, 6 and 7. The fins are of substantially triangular cross-section and are of increasing height throughout the tapering length of the segment concerned. Thus, it will be seen that the fins 7 are higher than the fins 5 which are themselves of tapering shape. The depth of these fins is such that from one end of the segment to the other they provide a substantially straight line which is in alignment with an imaginary line defining a cylindrical shape around the tapering surfaces of the segments.

Further abutments are provided in the form of fins 8 to 12 of substantially triangular form and which once again are of increasing height throughout the tapering length of each segment. Thus, circumferentially extending fins 8 and 9 extend around the longitudinally extending axis of the assembled plug at right angles thereto, the fin 9 being higher than the fin 8. These two fins are followed by a further two fins 10 and 11 which are also of triangular cross-section but which are arranged as axially elongate rings. Thus, as will most clearly be seen from Figure 1 these rings are not normal to the longitudinally extending axis of the plug. If desired these rings could be replaced by fins which were helical. In any case, whether helical or axially elongate, the fins 10 and 11 are opposite handed, again as will be seen from Figure 1 and the fin 11 is higher than the fin 10. Finally the end of each is defined by a further radially extending fin or flange 12.

As mentioned above these fins or flanges 5 to 12 are all arranged so that their outer extremities are defined by an imaginary cylinder co-axial with the longitudinally extending centre line of the plug when the two segments are closed together.

The end of each segment spaced away from the web 3, which acts as a hinge, includes a neck portion 15 of reduced diameter which has a circumferential location groove 16 formed therein. When the two segments are folded together the two neck portions provide a cylindrical boss on which is placed a sleeve 17 provided with an outwardly projecting flange 18 which locates in the groove 16. This sleeve 17 when in position on the segments acts to locate the two segments together and to prevent expansion of the plug adjacent the open end 37 of a longitudinally extending bore 13 which is formed by the two segments the other end of the plug is held in alignment by the hinge 3. This bore 13 is provided by semicircular grooves 19 provided on the flat faces 4 of the segments. The outside diameter of the sleeve 17 is such that it is approximately equal to the longest diameter on the body of the assembled plug. The grooves 19 carry a series of circumferential ribs 20 which can be shaped so that when the segments are close together they form a tapered screw thread. Alternatively they may just provide a series of circumferentially extending ribs around the bore provided by the two grooves 19 when

closed together.

In order to assist location of the segments when folded together guides 22, 23, 24 and 25 are provided on each segment. These guides consist of upwardly projecting arms, the outer ends of which are chamfered as indicated at 26, on guide 23 in Figure 2. These guides are effective when a retention device, to be described later, is inserted into the plug to expand it, in that they prevent a relative rotation of the two segments of the expanding plug. The guides 22, 23, 24 and 25 are not shown in Figure 1 in order to simplify this Figure.

As referred to above the bore 13 provided by the grooves 19 is tapered but at its outer open end indicated by reference numeral 27 in Figure 3 the taper ceases so there is an end portion which has walls which are substantially cylindrical, this portion being generally indicated by reference numeral 28. As will be seen this parallel sided portion is co-axial with the neck portion 15. This parallel portion 28 allows appropriate engagement of a screw into the internal screw thread when provided, or the insertion of the ribbed pin, to be described, and avoids expansion of this portion 28 on further insertion of the screw or pin.

A retention element is provided which can be in the form of a screw or a circumferentially ribbed pin and the screw or pin may be of generally cylindrical shape with an overlying tapering toothed form or ribbing. This screw can be of normal configuration, for example as shown in Figure 8, and will not therefore be described further but a circumferentially ribbed pin for use with the plug is shown in Figure 5. The pin comprises a shank 14 having an enlarged head and provided with a series of circumferential ribs 29.

When the plug is used the retention element which is to be used to hold an orthopaedic device in place, in the manner to be described hereunder, is driven into the open end of the bore 27 and if there is a screw thread is rotated so that it extends into the bore. As the diameter of the bore decreases the retention element causes the segments 1 and 2 to move apart thus expanding the cross-sectional area of the plug. The ribs in the bore act to hold the retention means in place.

If the retention means is a pin as shown in Figure 5 which is not screwed however but merely ribbed then it can be driven in appropriately to have the same effect.

The retention element can be metallic and constructed from the range of metals used in orthopaedic implants, that is Cobalt-Chrome, Ti alloys, stainless steels or it can be made from synthetic polymer or polymeric, from the same range of biodegradable materials as are used in the segment construction or from some other synthetic polymer of known biocompatibility.

The operative use of the fastener is shown diagrammatically in Figures 4, 5 and 6. In these arrange-

ments a drill 30 is used to form a hole or opening 31 in the bone 32 to which an orthopaedic device, for example a plate, is to be fastened. The closed plug indicated by reference numeral 33 is placed in the hole or opening 31 in the bone and a hole or slot in the orthopaedic device 34 to be fixed to the bone is placed above it and the retention means, in this case a screw 35 is introduced through the opening 36 in the orthopaedic device and into the end of the bore 27 of the previously placed plug.

As mentioned above this retention element is either a screw or circumferentially ribbed pin. This is introduced into the cavity in the plug by either screwing, hammering or a combination of these. On insertion the screw or pin, which is generally cylindrical with an overlying tooth form engages in the internal bore of the plug and due to the conical overall shape of the internal bore 13 causes the segments of the plug to be displaced into the bone causing a tight interlocking. Thus the various fins on the outer surface of the segments have a depth to allow significant interlocking with cancellous bone. When a grip is required in less compliant bone such as cortical bone then alternative smaller external engaging surface forms and a lower degree of expansion of the fastener can be used. In the arrangement described the external tooth form of the various fins is such that when engaging bone these do not allow for any rotational unlocking of the fastener.

The advantages of the device are that preparation is simple merely by drilling a hole into bone and the use of a two part construction, that is a plug and separate retention means allows the materials to be better utilised, that is the retention means, in the form of a pin or screw acts as a spacer and requires high tensile strength, this is obviously compatible with a metal but also with an aligned or directionally fibre reinforced polymer matrix material system, which can be relatively easily manufactured into an essentially simple cylindrical structure.

A third advantage is that the plug is a spacing and shear load element with lower specific loading. This is therefor amenable to manufacture in non-reinforced polymers, by injection or compression moulding to form the complex shape required.

The sleeve 17 for preventing expansion of the plug adjacent the open end of the bore can be made from any convenient material, for example metal or a synthetic plastics material.

The particular configuration of the plug blank has numerous advantages as it can be made as a single moulding and folded into its operative position when required. A number of those plugs can also be moulded simultaneously as will be apparent to the person skilled in the art of moulding.

Claims

1. A fastener for securing an orthopaedic device to a bone comprising an expandable plug made from a biodegradable or biostable material and having two segments which when placed together provide an open ended tapered inner bore provided with retention means, and a retention element which can act on the orthopaedic device to locate it against said bone and which when entered into the bore under pressure locates in the retention means and acts to expand the plug and interconnection means spaced away from the open end of the inner bore for holding said segments in alignment during insertion.
2. A fastener for securing an orthopaedic device to a bone as claimed in claim 1 in which said interconnection between the segments is in the form of a hinge.
3. A fastener for securing an orthopaedic device to a bone as claimed in claim 1 or claim 2 in which said segments have outwardly projecting abutments to engage and locate in an opening in said bone to which the device is to be fastened.
4. A fastener for securing an orthopaedic device to a bone as claimed in claim 3 in which the outwardly projecting abutments have an external tooth form of relatively large pitch.
5. A fastener for securing an orthopaedic device to a bone as claimed in claim 4 in which the abutments include radial and helical fins.
6. A fastener for securing an orthopaedic device to a bone as claimed in claim 3 in which alternative helical fins are opposite handed.
7. A fastener for securing an orthopaedic device to a bone as claimed in claims 1 to 6 in which the retention means in the bore are provided by a series of engagement ribs.
8. A fastener for securing an orthopaedic device to a bone as claimed in claim 6 in which the engagement ribs are in the form of a tapered screw thread.
9. A fastener for securing an orthopaedic device to a bone as claimed in any one of claims 1 to 8 in which the retention element is a screw or a circumferentially ribbed pin.
10. A fastener for securing an orthopaedic device to a bone as claimed in claim 8 in which the screw or pin is of generally cylindrical shape with an

overlying tapering tooth form or ribbing.

11. A fastener for securing an orthopaedic device to a bone as claimed in claims 1 to 10 including means for preventing expansion of the plug adjacent the open end of the bore. 5
12. A fastener for securing an orthopaedic device to a bone as claimed in claim 11 in which the said means comprise a sleeve surrounding the plug. 10
13. A fastener for securing an orthopaedic device to a bone as claimed in claims 1 to 12 in which the segments are provided with guides to assist assembly together to form the expandable plug. 15

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Fig.1.

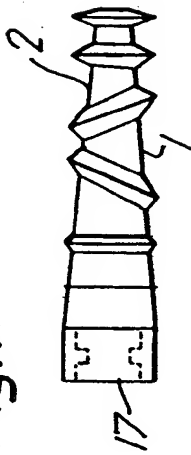


Fig.4.

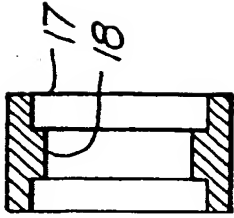


Fig.2.

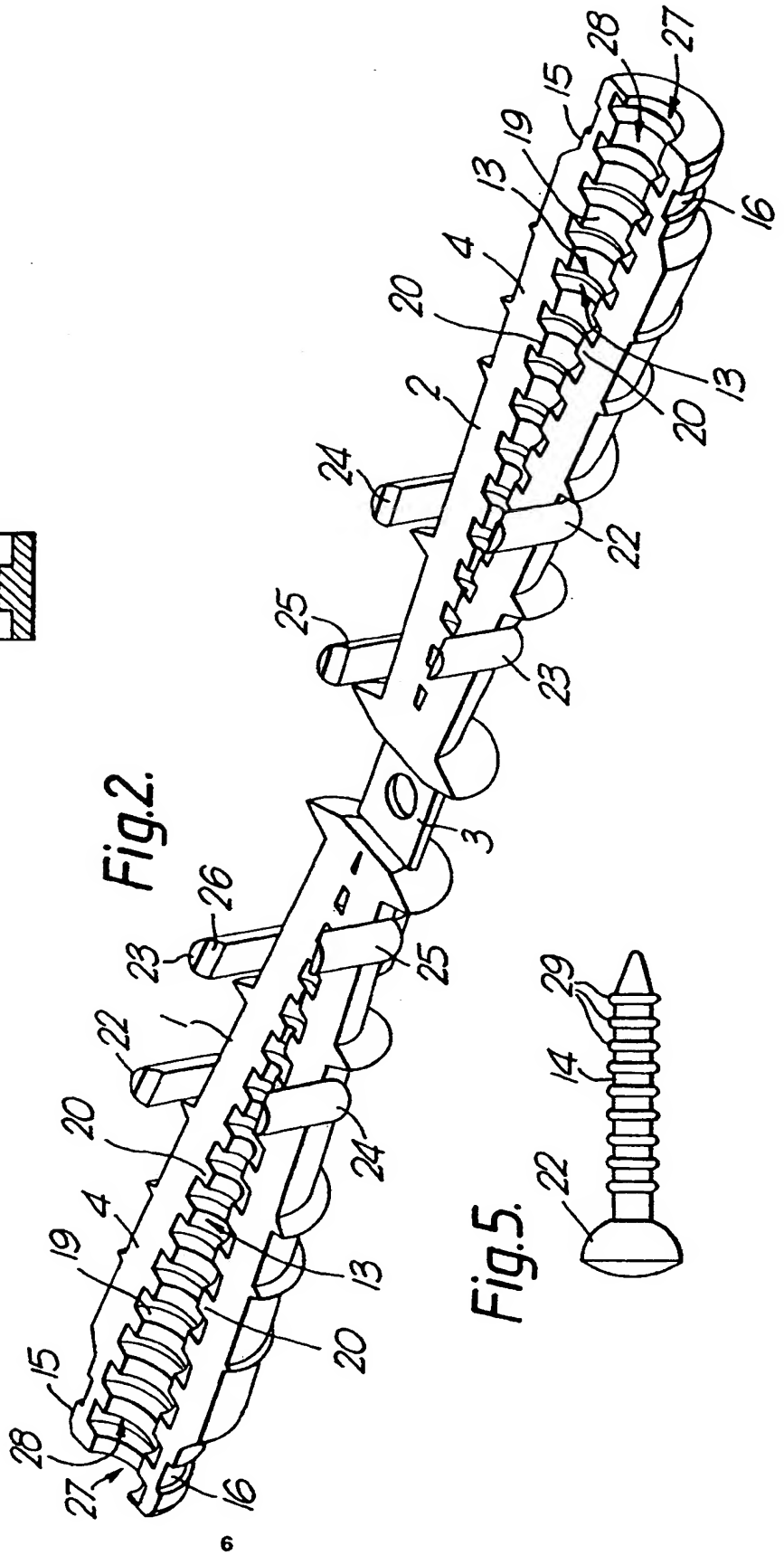


Fig.5.

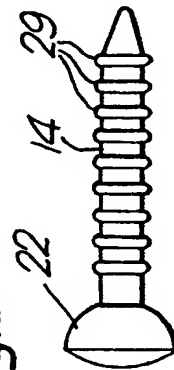


Fig.3.

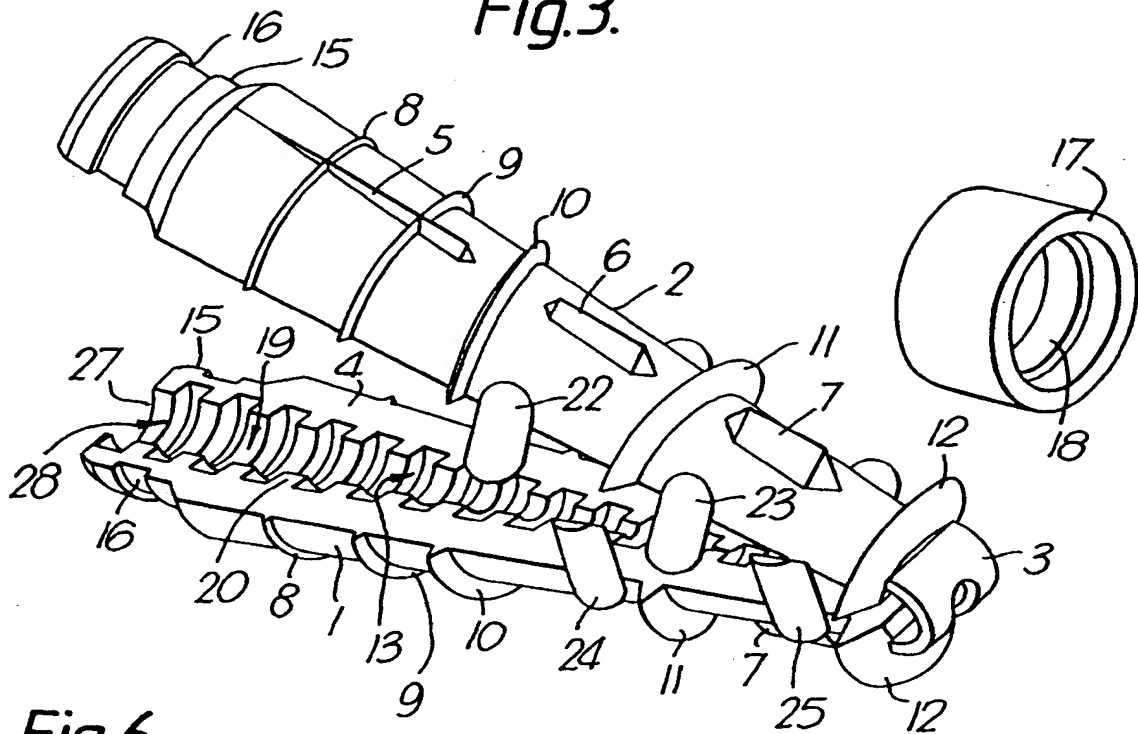


Fig.6.

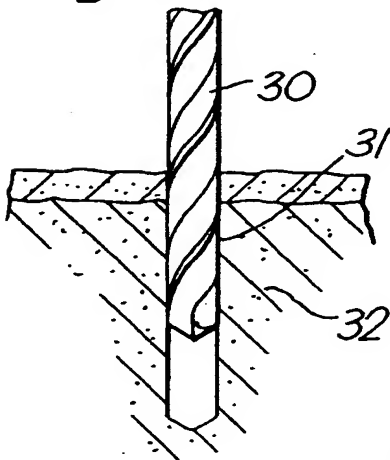


Fig.7.

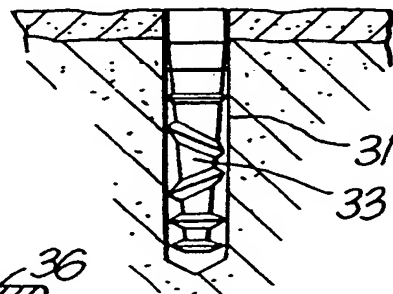
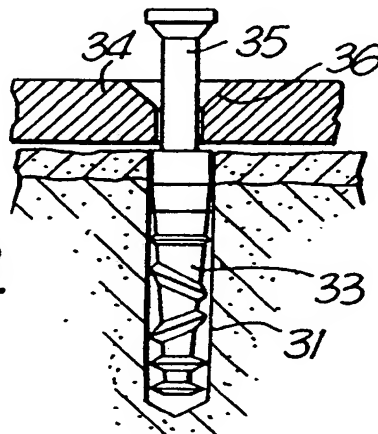


Fig.8.





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EUROPEAN SEARCH REPORT

Application Number

EP 92 30 7050

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. CL.5)
Y	DE-C-4 006 671 (HEUEL) * abstract; figures 1,4 *	1-5,7,9, 11-13	A61B17/56 F16B13/12
Y	EP-A-0 340 159 (SULZER) * column 2, paragraph 2 -paragraph 3 * * column 2, line 35; figure 3 *	1-5,7,9, 11-13	
A	FR-A-877 639 (JORDAN) * page 3, line 20 - line 42; figures 11,12,15,16 *	5	
A	EP-A-0 237 379 (SOCIETE EUROPEENNE DE PROPULSION) * column 5, paragraph 4; figure 6 *	11,12	
A	EP-A-0 150 605 (PLAS PLUGS) * page 5, paragraph 2; figure 5 *	13	
A	WO-A-8 603 666 (DRÄNERT) * page 14, line 27 - line 30; claim 13; figure 1 *	1	
A	FR-A-2 161 175 (SCHMITT)		TECHNICAL FIELDS SEARCHED (Int. CL.5)
A	DE-A-2 454 022 (UPAT-MAX LANGENSIEPEN)		A61B A61F F16B
A	US-A-3 022 701 (POTRUCH)		
A	DE-A-1 936 360 (UPAT-MAX LANGENSIEPEN)		
A	EP-A-0 409 364 (MECRON)		
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 29 OCTOBER 1992	Examiner BARTON S.
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons A : member of the same patent family, corresponding document</p>			

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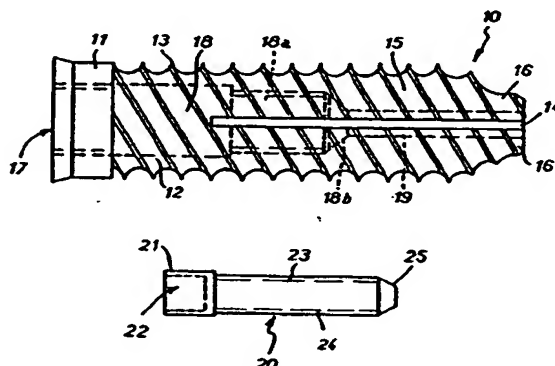
(72) Inventeur(s) : Porges Antoine.

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(74) Mandataire : Cabinet Bonnet Thirion.

(54) Vis orthopédique autotaraudeuse à expansion.

(57) La vis orthopédique (10) prévue pour l'ancrage dans un os d'éléments de prothèses articulaires comporte une tête (11) et un corps (12) pourvu de filets autotaraudants et présente une extrémité distale fendue (15). Un canal central traverse la vis longitudinalement et comprend, de part et d'autre d'une partie médiane filetée (18a), du côté tête (11) un premier conduit (18) de diamètre supérieur au diamètre à fond de filets de la partie médiane (18a), et du côté de l'extrémité distale (15) un second conduit (19) de diamètre inférieur au diamètre entre arêtes de la partie médiane. Une vis auxiliaire (20) peut être engagée dans le filetage de la partie médiane (18a) de la vis (10) et vient forcer, par une extrémité tronconique (25) sur le raccordement tronconique (18b). La fente (14) et le second conduit (19) sont assez longs pour que l'expansion de la vis (10) intéresse d'abord la partie du corps proche du raccordement (18b).



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"Vis orthopédique autotaraudeuse à expansion"

L'invention se rapporte à une vis orthopédique expansible, notamment pour l'ancrage dans un os d'éléments de prothèses articulaires, tels que cotyle, comportant une tête de diamètre supérieur à celui d'un corps cylindrique pourvu de filets autotaraudants et présentant une extrémité distale fendue définissant une pluralité de lamelles séparées par autant de fentes radiales, un canal central se rétrécissant de la tête à l'extrémité distale, apte à recevoir un moyen d'expansion de la partie distale.

En chirurgie orthopédique, il est nécessaire d'ancrer de façon stable des éléments de prothèse articulaire, tels que des cupules cotyloïdes ou des plateaux tibiaux. Or l'os sous-jacent est plus ou moins spongieux, et de surcroît la nécessité de poser une prothèse articulaire vient souvent d'une dégénérescence des os de l'articulation. Il est dès lors à craindre que les vis orthopédiques utilisées pour ancrer les éléments de prothèse prennent du jeu à plus ou moins court terme.

L'utilisation de vis autotaraudeuses, dont les filets d'entrée sont interrompus par des fraises pour leur donner la faculté de former le taraudage dans l'os sans soumettre l'os à des efforts transversaux, augmente le risque de prise de jeu par suppression de la tendance au frettage par l'os des vis à corps légèrement conique.

Dans l'état de la technique, décrit notamment par le document US-A-4 013 071, on a utilisé des vis creuses dont l'extrémité distale est expansible en y ménageant des fentes radiales qui définissent des lamelles distales expansibles, l'expansion étant provoquée par une tige interne dont la tête se visse dans celle de la vis orthopédique, et dont la pointe sollicite en écartement en V les lamelles distales.

Plus précisément, l'écartement en V des lamelles est obtenu par la pression exercée par la pointe de la tige interne contre le rétrécissement du canal traversant la vis

creuse, à proximité immédiate de l'extrémité distale de la vis orthopédique.

Les documents FR-A-2 615 726 et US-A-2 490 364 décrivent également des dispositifs d'ancrage à expansion à usage prothétique, qui ne sont pas à proprement parler des vis.

L'inconvénient majeur de l'expansion en V des lamelles distales de la vis orthopédique creuse, fendue et expansible décrite par le document US-A-4 013 071, considéré ici comme reflétant l'état de la technique le plus proche de la présente invention, est que l'expansion intéresse seulement la partie distale de la vis, et maximale à son extrémité, s'annule après quelques filets. Ainsi l'amélioration de la prise ne touche que ces filets terminaux et dans la mesure où les lamelles sont écartées à leur hauteur. Et de surcroît l'expansion se produit là où l'os est le moins résistant, sa consistance allant décroissant avec la distance à l'articulation.

La présente invention a pour but de réaliser une vis orthopédique expansible qui répond aux nécessités de la pratique mieux que les vis de l'état de la technique prévues pour le même usage, notamment en fournissant une expansion radiale mieux répartie sur la longueur de la vis, et intéressant des régions plus consistantes de l'os où elles sont vissées.

A cet effet l'invention propose une vis orthopédique expansible, notamment pour l'ancrage dans un os d'éléments de prothèses articulaires, tels que cotyle, comportant une tête de diamètre supérieur à celui d'un corps cylindrique pourvu de filets autotaraudants et présentant une extrémité distale fendue définissant une pluralité de lamelles séparées par autant de fentes radiales, un canal central se rétrécissant de la tête à l'extrémité distale apte à recevoir un moyen d'expansion de la partie distale, caractérisée en ce que le canal central comprend, de part et d'autre d'une partie médiane filetée intérieurement, un premier conduit débouchant dans la tête avec un diamètre

longueur de fente est ainsi suffisante pour que les lamelles ne subissent pas, à l'expansion, une concentration des efforts de flexion à leur racine.

De préférence encore, les lamelles et les fentes radiales qui les séparent sont respectivement au nombre de deux. La section des lamelles est alors suffisante pour que les efforts au vissage ne provoquent une torsion des lamelles autour de l'axe de la vis.

Des caractéristiques secondaires et des avantages de l'invention ressortiront d'ailleurs de la description qui va suivre, à titre d'exemple, en référence aux dessins annexés dans lesquels :

la figure 1 représente une vis orthopédique autotaraudeuse selon l'invention ;

la figure 2 représente une vis auxiliaire propre à s'insérer dans la vis de la figure 1.

Selon le mode d'exécution choisi et représenté aux figures 1 et 2, une vis orthopédique 10 dans son ensemble, réalisée en matériau biocompatible, dans le présent cas en Titane TA6V, comporte une tête 11 avec une empreinte creuse hexagonale 17 prévue pour recevoir une clé six pans, et un corps 12 fileté sur toute sa longueur. Le corps est traversé, axialement, par un canal qui comporte, de part et d'autre d'une partie médiane 18a filetée intérieurement, du côté tête 11, un premier conduit 18 cylindrique de diamètre supérieur au diamètre à fond de filet de la partie médiane, et du côté de l'extrémité distale 15, un second conduit cylindrique 19 de diamètre inférieur au diamètre entre arêtes du filetage intérieur de la partie médiane 18a. Le raccordement 18b entre la partie médiane 18a et le second conduit 19 est en tronc de cône avec la pointe tournée vers l'extrémité distale. Une fente 14 étendue longitudinalement et passant par l'axe de la vis 10 entaille le corps depuis l'extrémité distale jusqu'au premier conduit 18. Cette fente, ou paire de fentes radiales 14 si l'on considère que le canal central s'interpose entre elles, définit deux lamelles 16 susceptibles de s'écarter par déformation

élastique ou plastique du matériau dont est constituée la vis 10.

On notera que la tête 11 est cylindrique sur environ deux tiers de son étendue longitudinale, puis s'évase en tronc de cône jusqu'à sa tranche proximale. Cet évasement se logera dans une fraisure tronconique de l'élément prothétique à ancrer, ici une cupule cotyloïde, pour dégager un espace hémisphérique creux destiné à recevoir une tête de fémur, généralement prothétique elle aussi.

Une fraisure entame, le long d'une fente 14, le filetage extérieur de la vis prothétique à partir de la partie distale, en sorte de ménager une arête tranchante des filets en arrière de la fente dans le sens de vissage, pour permettre aux filets de tailler le filetage complémentaire dans l'os. En outre l'extrémité distale de la vis 10 est en pointe tronconique, pour permettre l'engagement de cette extrémité distale dans un avant-trou de diamètre plus faible ménagé dans l'os avant la mise en place de la vis.

Une vis auxiliaire 20 qui présente une tige pleine 23 avec un filetage 24 complémentaire du filetage intérieur de la partie médiane 18a du canal central, est prévue pour provoquer l'expansion de la vis orthopédique 10. La vis 20 présente une tête cylindrique 21, prévue pour passer librement dans le premier conduit 18, et munie d'une empreinte creuse à section hexagonale 22 prévue pour recevoir une clé en tige à six pans. A l'extrémité opposée à la tête 21, la vis se termine en tronc de cône 25, de même angle au sommet que le raccordement 18b entre la partie médiane 18a et le second conduit 19. La longueur filetée de la vis 20 est intermédiaire entre celle de la partie médiane filetée 18a et les longueurs cumulées de cette partie médiane 18a et du second conduit 19.

En utilisation, après que la position de la cupule cotyloïde prothétique ait été assurée, des avant-trous sont pratiqués dans l'os iliaque sous-jacent avec un diamètre un peu supérieur à celui de la tranche distale de la vis, puis

des vis sont engagées dans les avant-trous et vissées à l'aide d'une clé six pans adaptée, en pratiquant le filetage interne dans l'os.

5 Puis une vis auxiliaire 20 est engagée dans la partie médiane 18a du canal central jusqu'à ce que la pointe tronconique 25 prenne contact avec le raccordement tronconique 18b. Ensuite, à l'aide d'une clé six pans engagée dans l'empreinte 22, on visse à force la vis
10 auxiliaire 20 pour provoquer une expansion des lamelles 16 par écartement. L'expansion serait maximale à hauteur de la pointe 25 de la vis 20 si l'os présentait une résistance uniforme avec l'accroissement de profondeur. En fait, en raison de l'élasticité des lamelles 16 et de leur capacité de déformation plastique, l'expansion maximale peut être
15 plus éloignée de la tête si l'os cède plus facilement. Néanmoins la vis auxiliaire est trop courte pour pénétrer dans le second conduit jusqu'à l'extrémité distale de la vis 10, de sorte qu'à cette extrémité distale l'expansion est tempérée par la souplesse des lamelles 16. En fait,
20 l'expansion de la vis 10, et donc l'enfoncement de la vis auxiliaire 20 seront déterminés par le chirurgien-opérateur pour un ancrage sûr sans excès d'expansion.

Bien entendu, l'invention n'est pas limitée à l'exemple décrit, mais en embrasse toutes les variantes
25 d'exécution.

REVENDECATIONS

1. Vis orthopédique expansible (10), notamment pour l'ancrage dans un os d'éléments de prothèses articulaires, tels que cotyle, comportant une tête (11) de diamètre supérieur à celui d'un corps cylindrique (12) pourvu de filets autotaraudants et présentant une extrémité distale fendue (15) définissant une pluralité de lamelles (16) séparées par autant de fentes (14) radiales, un canal central (18) se rétrécissant de la tête (11) à l'extrémité distale (15) apte à recevoir un moyen d'expansion (20) de la partie distale, caractérisée en ce que le canal central comprend, de part et d'autre d'une partie médiane (18a) filetée intérieurement, un premier conduit (18) débouchant dans la tête (11) avec un diamètre supérieur au diamètre à fond de filet de la partie médiane (18a) et un second conduit (19) s'étendant dans la partie distale (15) avec un diamètre inférieur au diamètre entre arêtes de filets de la partie médiane (18a), tandis que le moyen d'expansion est une vis auxiliaire (20) apte à s'engager à partir de la tête (11), dans le filetage de la partie médiane (18a) et à expander la partie distale (15) en forçant dans le second conduit (19).

2. Vis orthopédique selon la revendication 1, caractérisée en ce que la vis auxiliaire (20) présente une tige (23) portant un filetage (24) avec une longueur intermédiaire entre celle de la partie médiane (18a) du canal central, et la longueur cumulée de cette partie médiane (18a) et du second conduit (19).

3. Vis orthopédique selon l'une des revendications 1 et 2, caractérisée en ce que la vis auxiliaire (20) présente une pointe tronconique (25) complémentaire d'un tronc de cône (18b) raccordant la partie médiane (18a) au second conduit (19).

4. Vis orthopédique selon l'une quelconque des revendications 1 à 3, caractérisée en ce que la vis auxiliaire (20) présente une tête à six pans creux apte à se loger dans le premier conduit (18).

5. Vis orthopédique selon une quelconque des revendications 1 à 4, caractérisée en ce qu'elle présente une tête (11) avec une empreinte en creux à six pans (17) de diamètre entre plats au moins égal à celui du premier conduit (18), et extérieurement un élargissement tronconique d'extrémité prolongeant une partie cylindrique.

6. Vis orthopédique selon une quelconque des revendications 1 à 5, caractérisée en ce que les fentes (14) s'étendent depuis l'extrémité distale au moins jusqu'à l'origine du premier conduit (18).

7. Vis orthopédique selon une quelconque des revendications 1 à 6, caractérisée en ce que le nombre de fentes (14) et de lamelles expansibles (16) est égal à deux.

1/1.

FIG. 1

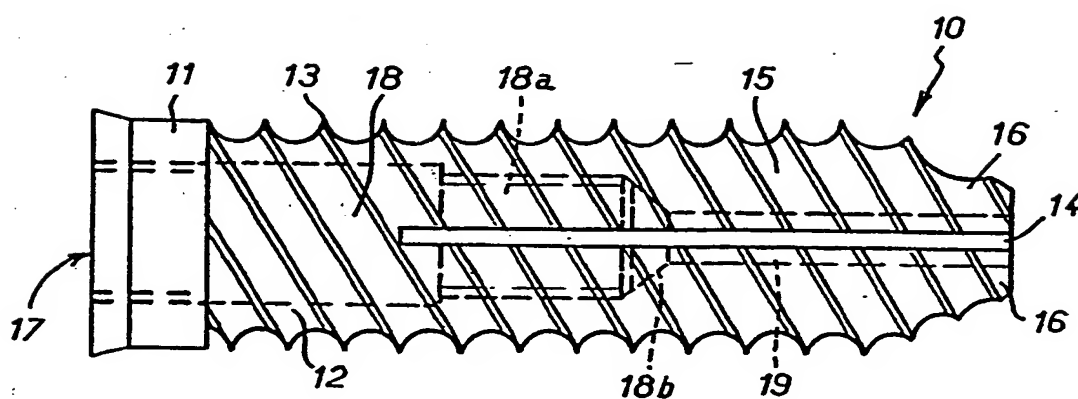
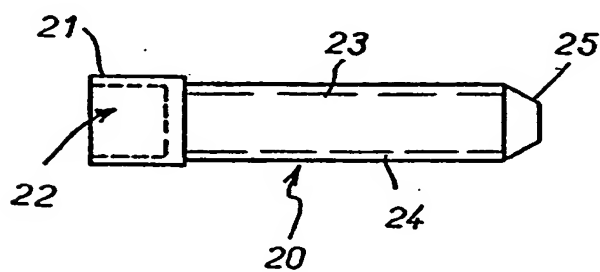


FIG. 2



DOCUMENTS CONSIDERES COMME PERTINENTS		Revendications concernées de la demande examinée
Catégorie	Citation du document avec indication, en cas de besoin, des parties pertinentes	
Y A	WO-A-9 106 252 (BIEDERMANN) * page 2, ligne 7 - page 3, ligne 20; figures *	1,3,4,7 2,5
Y A	US-A-4 711 232 (FISCHER) * colonne 3, ligne 11 - ligne 37 * * colonne 3, ligne 58 - colonne 4, ligne 4; figures 1,3 *	1,3,4,7 2
A	EP-A-0 340 159 (SULZER) * colonne 2, ligne 34 - colonne 3, ligne 22; figures 1-4 *	1,2,5-7
A,D	US-A-4 013 071 (ROSENBERG) * colonne 2, ligne 38 - colonne 3, ligne 43; figures 1-4 *	1-3,5,7
A,D	FR-A-2 615 726 (LANDOS) * page 4, ligne 18 - page 7, ligne 22; figures 5-10 *	1-4,6,7
		DOMAINES TECHNIQUES RECHERCHES (Int. Cl.5)
		A61B
Date d'achèvement de la recherche 24 FEVRIER 1993		Examinateur KLEIN C.
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